

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Catostomus discobolus yarrowi*

COMMON NAME: Zuni bluehead sucker

LEAD REGION: Region 2

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION:

Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 11, 2004

90-day positive - FR date:

12-month warranted but precluded - FR date:

Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? Yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.

Higher priority listing actions, including court-approved settlements, court-ordered statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

☐ Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined): October 2001

☐ Candidate removal: Former LP:

☐ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act’s definition of “species.”

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Fish, Catastomidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Arizona, New Mexico

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Apache County, Arizona; McKinley County, New Mexico

LAND OWNERSHIP: The Zuni bluehead sucker habitat remaining is approximately 3 stream miles (mi) (4.8 kilometers (km)) in the Rio Nutria watershed, New Mexico. Zuni bluehead sucker stream habitat is located on the Cibola National Forest (less than 1 percent), Zuni Indian Reservation (40 percent), and private lands (59 percent). Currently, all of the Zuni bluehead suckers reside in the upper Rio Nutria and Agua Remora. None have been collected from the Rio Pescado since 1993.

Rio Nutria: Private: 1.4 mi, 2.3 km (47 percent).
Tribal: Zuni Pueblo: 1.2 mi, 2 km (40 percent).

Tampico Draw: Private: 0.2 mi, 0.3 km (6 percent).

Headwater Springs: Federal: Cibola National Forest: 0.03 mi, 0.05 km (less than 1 percent).

Other Headwater Springs: Private: 0.2 mi, 0.2 km (6 percent).

In Arizona, populations of Zuni bluehead sucker are found in approximately 27.5 mi (44 km) within the Kinlichee watershed. It is unlikely that this whole length is actually occupied habitat because few sites within the drainage have been sampled and the streams are susceptible to drying under drought conditions. The following values represent potentially suitable habitat; all the streams occur on Navajo Nation lands.

Black Soil Wash: Tribal: Navajo Nation: 5.1 mi (8.2 km) plus 1.5 mi (2.4 km) of unnamed tributary.

Scattered Willow Wash: Tribal: Navajo Nation: 7.0 mi (11.2 km).

Kinlichee Creek (Bear Canyon): Tribal: Navajo Nation: 10.8 mi (17.4 km).

Kinlichee Creek (downstream of confluences): Navajo Nation: Tribal: 4.3 mi (6.9 km).

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BIOLOGICAL INFORMATION

Species Description

Propst (1999) described the Zuni bluehead sucker (*Catostomus discobolus yarrowi*) as fusiform (torpedo shaped), slender, and with a terminal mouth. The Zuni bluehead sucker has a bluish head, silvery tan to dark green back, and the sides and abdomen are yellowish to silvery white. Adults are mottled slate-gray, almost black, dorsally and cream white ventrally. During the spawning season, males may be differentiated by coarse tubercles on the anal and caudal fins and the caudal peduncle, as well as distinctive breeding coloration; dorsally they are intense black with a bright red lateral band and a white abdomen (Smith 1966; Propst and Hobbes 1996). Propst and Hobbes (1996) reported most suckers did not exceed 8 inches (in.) (20.3 centimeters (cm)); however, some individuals exceeded 9 in. (25 cm) total length.

Taxonomy

Smith (1966) and Smith et al. (1983) postulated that the Zuni bluehead sucker subspecies was from a hybrid origin, whereby a headwater stream of the Rio Grande was captured by upstream erosion of a headwater stream of the Zuni River during the late-Pleistocene (Propst 1999). This event brought the Rio Grande sucker (*Catostomus plebeius*) into contact with a resident bluehead sucker (*Catostomus discobolus*). Based on shared physical traits, Smith (1966) and Smith et al. (1983) believed this contact area was in the upper reaches of the Rio Nutria. Crabtree and Buth (1987) provided allozymic data supporting subspecific differentiation of upper Little Colorado River (*C. discobolus*) from its conspecifics prior to introgression of the bluehead sucker and Rio Grande sucker in the upper Rio Nutria. Regardless of the mechanism for differentiation, the Zuni bluehead sucker is a recognized subspecies (Propst 1999).

Habitat

Carman (2008) describes Zuni bluehead sucker habitat as stream reaches with clean, perennial water flowing over hard substrate, such as bedrock. Silt-laden habitat, such as beaver ponds, represents poor or marginal habitat. Propst and Hobbes (1996) reported that Zuni bluehead suckers were collected mainly in pool and pool-run habitats. Such habitat areas were typically shaded, and water velocity was less than 0.1 meter per second (0.3 feet per second). Most specimens were found in water that was 30 to 50 cm (12 to 20 in.) deep, where the substrate ranged from cobble and boulders to bedrock. Pools were often edged by emergent aquatic vascular plants (mainly willows). The past 5 years of monitoring by New Mexico Department of Game and Fish (NMDGF) shows that the pools are much shallower, reducing the amount of available habitat (Carman 2008). The Zuni bluehead sucker feeds primarily on algae scraped from rocks, rubble, and gravel substrates (Winter 1979; Sublette et al. 1990). Periphytic and

perilithic algae are generally abundant in reaches where Zuni bluehead suckers are common (Carman 2004).

Historical Range/Distribution

The Zuni bluehead sucker is endemic to the headwaters of the Little Colorado River in east-central Arizona and west-central New Mexico (Smith 1966; Smith et al. 1983; Crabtree and Buth 1987; Propst and Hobbes 1996; Propst 1999). The Zuni bluehead sucker was once common in the Little Colorado and Zuni River drainages, but its range has been reduced by over 90 percent (Propst 1999), and its numbers by an unknown amount in the last 20 years. The Zuni bluehead sucker is now found in low numbers in Kinlichee Creek in Arizona (NMDGF in litt., 2000), and is restricted to three semi-isolated populations in the upper Rio Nutria drainage in west-central New Mexico (Carman 2008).

New Mexico - The type specimen of the Zuni bluehead sucker was collected from the Zuni River near the Zuni Pueblo, New Mexico, in 1873 (Cope 1874). It was not subsequently collected in New Mexico until W.J. Koster (University of New Mexico, Museum of Southwestern Biology) collected the species in the Rio Nutria in 1948 and the Rio Pescado in 1960 (Propst 1999). Several chemical treatments were made in the Zuni River drainage in New Mexico during the 1960s to remove green sunfish (*Lepomis cyanellus*), fathead minnow (*Pimephales promelas*), and suckers (Catostomidae) from the Rio Nutria to aid in the establishment of a rainbow trout (*Oncorhynchus mykiss*) sport fishery in reservoirs on the Zuni Pueblo (Winter 1979). These treatments eliminated the Zuni bluehead sucker from most of the Zuni River drainage. However, the population of suckers in the Rio Nutria was maintained by dispersal of individuals from upstream, untreated reaches, such as Agua Remora (Winter 1979; Propst 1999).

In New Mexico, Hanson (1980) documented the primary areas of occurrence to be Radosevich Creek (renamed Agua Remora), upper Rio Nutria (from the mouth of Nutria Box Canyon near the eastern boundary of the Zuni Indian Reservation upstream), and the confluence of the Rio Pescado and Rio Nutria. Elsewhere in the Zuni River drainage and Tampico Draw, the Zuni bluehead sucker was rare or absent. By the late 1970s the Zuni bluehead sucker's range had been reduced by at least 50 percent, and the species was limited to the upper Zuni River drainage and Kinlichee Creek (Hanson 1980; Smith et al. 1983).

Arizona - In Arizona, Smith (1966) reported the subspecies in four small streams (Propst 1999). Smith et al. (1983) collected Zuni bluehead suckers in Arizona from East Clear Creek and Kinlichee Creek for genetic analysis. By the early 1980s, the range in Arizona was apparently reduced to only Kinlichee Creek (Smith et al. 1983). Crabtree and Buth (1987) confirmed that the Zuni bluehead suckers still persisted in Kinlichee Creek in 1987. Genetic studies are currently being conducted to determine if the Arizona subpopulations are a distinct subspecies.

Current Range/Distribution

The Zuni bluehead sucker was once common in the Little Colorado and Zuni River drainages, but its range has been reduced by over 90 percent in the last 20 years (Propst 1999).

New Mexico - The Zuni bluehead sucker persists in three semi-isolated populations in a small fraction (3 mi; 4.8 km) of its former range, and occurs mainly upstream of the mouth of the Rio Nutria Box Canyon (Propst 1999; Propst et al. 2001; Carman 2008). Within this area, it is most common near the Rio Nutria Box Canyon mouth, the confluence of the Rio Nutria and Tampico Draw, and headwater springs such as Agua Remora (Stroh and Propst 1993; Propst and Hobbes 1996; Propst 1999; Propst et al. 2001, Carman 2007, 2008). The Zuni bluehead sucker is rare or absent elsewhere in the Zuni River drainage in New Mexico (Hanson 1980; Stroh and Propst 1993). Fish surveys from 1990 to 2009 found that Zuni bluehead sucker populations in headwater springs like Agua Remora and upper Rio Nutria were stable. In the 1990s the population at the Zuni River confluence with the Rio Nutria and Rio Pescado was declining, and the populations in the Rio Pescado and lower Zuni River were almost depleted (Stroh and Propst 1993). The Zuni bluehead sucker has not been collected from the Zuni River or Rio Pescado since 1993 (Table 1).

Propst et al. (2001) stated that dispersal of the Zuni bluehead sucker from upstream populations may augment downstream populations, but upstream movement is generally blocked by physical obstructions, such as natural waterfalls, irrigation diversions, and impoundments. Currently, there are few diversions and impoundments within the 3 mi of occupied habitat (Stephanie Carman, NMDGF, pers. comm., 2009). The irregular occurrence of the Zuni bluehead sucker in reaches downstream from the mouth of Nutria Canyon indicates limited downstream dispersal from currently occupied stream reaches. No Zuni bluehead suckers were found in the Rio Nutria between the canyon mouth and the confluence of the Rio Pescado. In the confluence area, a few large individuals were occasionally collected in the 1990s. The absence of smaller individuals suggests that it is the dispersal of larger individuals from upstream reaches that maintains the Zuni bluehead sucker in this area (Propst et al. 2001).

Arizona - In 2000, Zuni bluehead suckers were collected from Kinlichee Creek. A genetic evaluation is being conducted to determine if these fish are a distinct subspecies.

Population Estimates/Status

The number of fish over time is not the best method to evaluate population trends due to variability in sampling effort. The best method for evaluating population trends is a catch per unit effort (CPUE) metric (i.e., number of fish per second of electrofishing). Unfortunately, the effort data prior to 1991 is unavailable; therefore, we may only make qualitative comparisons of the number of Zuni bluehead sucker collected over time (Table 1). Rio Nutria and the headwater springs have reasonably stable populations (a total of approximately 3 miles). However, in 2006, numbers found at Tampico Draw declined dramatically but rebounded in 2008 and 2009 (Table 1). The number of Zuni bluehead suckers collected on Forest Service land from Agua Remora has severely declined since 1977. Suitable perennial habitat exists on the private land that was not sampled in 2005, but permission was granted to sample this area every year since 2007 (Carman 2007).

Zuni bluehead sucker has not been collected from the Zuni River since 1978 or from the Rio Pescado since 1993 (Table 1). Much of the lower portions of historical habitat in the Zuni River and Rio Pescado are dry the majority of the year and are no longer suitable habitat. Continued

monitoring of these streams has confirmed the extirpation of the Zuni bluehead sucker from these rivers (NMDGF 2004; Carman 2007; 2008; 2009).

Table 1. Zuni bluehead sucker count data collected in New Mexico between 1977 and 2009. Data collected from the following references in 1977 (Winter 1977); 1978, 1979 (Hanson 1980); 1984 (Stefferd 1985); 1990 to 1993 (Propst and Hobbes 1996); and 2000, 2001, and 2004 to 2008 (collected by Zuni Pueblo and NMDGF personnel) (Carman 2009).

Stream	1977	1978	1979	1984	1990	1991	1992	1993	2000	2001	2004	2005	2006	2007	2008	2009
Zuni River	**	1	0	**	0	0	0	0	**	**	0	**	0	0	0	0
Zuni River 5*	**	0	7	**	0	7	0	2	0	**	**	**	0	0	0	0
Rio Pescado	**	93	67	**	2	0	0	4	0	**	0	**	0	0	0	0
Rio Nutria	**	220	50	**	38	55	170	49	205	88	76	117	41	45	59	151
Tampico Draw	160	0	1	**	0	11	0	0	49	**	22	32	1	0	1	33
Tampico Springs	**	**	**	**	**	**	**	**	***	***	***	***	***	77	130	48
Agua Remora	150	200	92	93	**	189	**	**	***	***	***	12	18	12	10	41
Dean Creek	**	1	1	**	0	0	0	0	**	**	**	**	**	**	**	**
Total	310	515	218	93	40	262	170	55	254****	88	98	161	60	57	200	273

*Zuni River 5 is near the confluence of Rio Nutria and Rio Pescado.

**No surveys conducted.

***No surveys conducted—access denied on private property.

****does not include 190 Zuni bluehead suckers collected in Arizona in 2000.

Slight declines were observed in CPUE of Zuni bluehead sucker in sampled areas, but the fish has rebounded slightly in Tampico Draw and Agua Remora (Table 2). Although the number of fish captured in 2008 increased substantially from 2006 and 2007 (Table 1), the majority of the increase came from Tampico Springs where there was an increased capture effort in 2008. In 2007, electrofishing effort at the springs was 129 seconds (0.59 sucker per second) and in 2008 it was 588 seconds (0.22 sucker per second) (Carman 2009). Tampico Springs CPUE has been declining consistently for the past 3 years (Carman 2009, Stephanie Carman, NMDGF, pers. comm., 2010).

Table 2. Catch per unit effort (CPUE = number of fish per second of electrofishing) of Zuni bluehead sucker collected in New Mexico in 1991 to 2009 collected by Zuni Pueblo and NMDGF personnel (Carman 2009). Blanks are years without CPUE data.

Stream	1991	1993	1994	1995	2000	2001	2004	2005	2006	2007	2008	2009
Zuni River	0.010											
Zuni River 5*												
Rio Pescado		0.002										
Rio Nutria	0.049	0.027	0.080	0.043	0.064	0.108	0.026	0.056	0.027	0.023	0.019	
Tampico Draw	0.084		0.015				0.024	0.118	0.000	0.000	0.004	0.067
Tampico Springs			0.276							0.589	0.221	0.147
Agua Remora	0.160		0.098					0.022	0.013	0.021	0.010	0.125
Dean Creek												
Total												

*Zuni River 5 is near the confluence of Rio Nutria and Rio Pescado.

In 2007, permission to sample an additional privately owned headwater spring was granted for the first time in many years; it has been sampled annually since (name is not disclosed due to private landowner privacy). This habitat is a series of semi-isolated pools occupied only by Zuni bluehead sucker. The Zuni bluehead suckers at the headwater spring are smaller than at other sites, ranging from 22-99 mm total length. There has been a decline in the number of large individuals at this site since it was last sampled in 1994 until the most current survey in 2009 (Carman 2009; Stephanie Carman, NMDGF, pers. comm., 2010). Facial deformities have been seen in approximated 5 percent of the population, indicating that there may be genetic inbreeding occurring in this isolated population (Carman 2009).

In 2005 (20) and 2006 (5), Zuni bluehead suckers over 150 mm total length were implanted with Passive Integrated Transponder (PIT) tags so that movement of individuals could be documented. No PIT tagged individuals were caught in 2006, 2007, 2008, or 2009. No additional Zuni bluehead suckers have been PIT tagged since 2006 because so few individuals over 150 mm were caught. Larval Zuni bluehead suckers have been confirmed in the Rio Nutria and the headwater springs each year since 2007, indicating successful spawning. However, young (less than 50 mm total length) Zuni bluehead sucker have not been seen in the Agua Remora headwater spring habitat, and only mature adults were present from 2005 through 2008. The lack of small Zuni bluehead sucker in Agua Remora indicates that green sunfish may be preying on young Zuni bluehead sucker and limiting recruitment (Carman 2008). Intensive efforts to remove green sunfish were undertaken, and in 2009 young-of-the-year suckers were confirmed at Agua Remora. Young Zuni bluehead suckers are commonly found in the other headwater spring habitat and Rio Nutria.

For several years, a sucker survey was conducted in Kinlichee Creek in Arizona on the Navajo Reservation. This is a historical collection site that had not been sampled since 1987 when the Zuni bluehead sucker was last documented (Crabtree and Buth 1987). As mentioned above, genetic testing is ongoing to determine the phylogenetic relationship of this population to those in New Mexico. Preliminary genetic results indicate that much of the Arizona populations are not of the Zuni bluehead sucker subspecies and may have been isolated from the Little Colorado River drainage for some time (Thomas Dowling, Arizona State University, pers. comm., 2008).

THREATS

The Zuni bluehead sucker has become imperiled in the last 100 years due to adverse effects of human activities in the watershed, including logging, road construction, overgrazing by livestock, reservoir construction, irrigation withdrawals, stocking of exotic fishes, piscicide treatment, beaver activity, and the introduction of crayfish (*Orconectes virilis*) (Hanson 1980; NMDGF 1988; 1994; Propst and Hobbes 1996; Propst 1999; Carman 2004). The NMDGF (1988; 1994) and Propst (1999) reported that the quality of the Zuni River drainage fish habitat had declined to a point that Zuni bluehead sucker populations were highly disjunct and greatly reduced in numbers and distribution.

In New Mexico, the documented historical fish fauna of the Zuni River drainage consisted of three species: roundtail chub (*Gila robusta*), speckled dace (*Rhinichthys osculus*), and Zuni bluehead sucker (Propst 1999). Roundtail chub no longer occur in the Zuni River, and speckled

dace were not caught in 2007, 2008, or 2009 (Propst 1999; Carman 2009). Zuni bluehead sucker survives in New Mexico only in the Rio Nutria and its small tributaries (Propst 1999).

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

The Zuni bluehead sucker is a stream obligate species and does not live in lakes and ponds. It currently occupies 3 mi (4.8 km) of streams in four areas (Rio Nutria-Nutria Box, Rio Nutria at Tampico Draw confluence, Tampico Springs, and Agua Remora) (Propst et al. 2001; Carman 2008). Zuni bluehead sucker range reduction and fragmentation are caused by discontinuous surface water flow, separation of inhabited reaches by reservoirs, and habitat degradation from fine sediment deposition (Propst and Hobbes 1996). Fine sediments reduce or prevent production of periphytic algae, the primary food of the species. Fine sediments, if mobilized during the spawning season, may also smother recently spawned eggs (Propst and Hobbes 1996).

Severe degradation to the watershed occurred through overgrazing, excessive timber harvest, and indiscriminate road construction. Although most of these activities occurred in the late 1800s and early 1900s, the subsequent erosion, gulying, headcutting, and loss of water continued to cause degradation of natural resources, including habitat for the Zuni bluehead sucker (NMDGF 2004). Impacts to the landscape were so severe that the Pueblo of Zuni brought litigation against the United States Government in the early 1970s. The settlement resulted in legislation, the Zuni River Watershed Act of 1990, which seeks to restore tribal lands affected by upstream resource damage (NMDGF 2004).

Road construction activities may have direct adverse effects on the watershed from soil erosion and sedimentation to the streams. Indirect adverse effects from fine sediment input would be caused by interrelated actions, such as ranch development, logging, grazing, off-road vehicle use, and other activities. Aerial photographs from 1935 and 1991 showed road density in the Cebolla and Rio Nutria subwatersheds rose 138 and 47 percent, respectively (NMDGF 2004). Forest Road 50, which is in the upper watershed of Zuni bluehead sucker habitat, was upgraded in 1999, and several roads were developed in 2007 for the Tampico Springs Subdivision.

Currently, the Environmental Impact Statement for the proposed upgrade of Forest Road 191D is under review to address potential effects and concerns on how this will affect the development of Tampico Springs Subdivision, which could potentially result in adverse effects on local and downstream resources (i.e., Zuni watershed and Zuni bluehead sucker). On January 29, 2007, the Cibola Forest Supervisor signed a Finding of No Significant Impact granting an easement to McKinley County for access across Forest Service land via Forest Road 191D. The granting of the right-of-way allows McKinley County to upgrade the road and take over maintenance. Forest Road 191D provides access to the upper Rio Nutria watershed. NMDGF and Zuni Pueblo filed an appeal to the decision (NMDGF 2007). The Environmental Assessment for the project stated that “There are no approved plans for any large developments on private land in the areas accessed by Forest Road 191D in the reasonably foreseeable future.” In 2003, portions of the watershed serviced by Forest Road 191D were proposed for development as Southern Cross Ranch. The development was subsequently withdrawn, and therefore it was not addressed in the Environmental Assessment. In November 2006, the Tampico Springs Ranch Subdivision submitted a property report to the McKinley County Commission for approval for dense

development (490 lots) in the same area once identified as Southern Cross Ranch. The Environmental Assessment did not analyze the direct, indirect, or cumulative impacts from the subdivision development. The Forest Service has prepared a draft Environmental Impact Statement to address the potential effects of upgrading Forest Road 191D for review and comments.

In early 2007, Tampico Springs 3000, LLC, presented a preliminary plat to McKinley County for Tampico Springs Ranch Subdivision. The subdivision is proposed just northeast of currently occupied Zuni bluehead sucker habitat. The subdivision would have a total of 490 lots, varying from 3 to 11.9 acres (1.2 to 4.8 hectares), each with an individual well and septic system. The geohydrologic investigation report, prepared for Phase I of the subdivision, states that water withdrawal is likely to affect flow at Brennan and Tampico Springs (MJDarrconsult, Inc. 2007). In January 2008, the plat for Phase I of the subdivision was approved by McKinley County with conditions, including metering of water wells to enforce the 0.3 acre-feet per year per household restriction.

In 2009, The Trust for Public Lands working with the Forest Service secured Congressional funding to purchase much of the sections closest to Zuni bluehead sucker habitat. Purchase was completed in August 2009 and the parcels are now under Forest Service management.

Additional roads would need to be built to access the remaining private lands in the subdivision. Increased density of roads, trails, and off-road vehicle use within the watershed has the potential to increase erosion and, consequently, sedimentation in creeks on which the Zuni bluehead sucker depend. The increased human population in the Rio Nutria watershed would most likely lead to increased human impacts through recreational use of the adjacent creeks occupied by Zuni bluehead sucker. The potential for increased human disturbance within the Nutria watershed appears imminent and is of grave concern.

Although recreationists could have a direct impact on creeks occupied by Zuni bluehead sucker through increased trails (sedimentation), off-road vehicle use (sedimentation), bathing (water pollution), and the introduction of nonnative species (i.e., dumping of aquariums, game fish), perhaps of greater concern is the increased risk of fire within the watershed. Severe wildfires capable of extirpating or decimating fish populations are a relatively recent phenomenon and result from the cumulative effects of historical or ongoing overgrazing by domestic livestock, (which removes the fine fuels needed to carry fire), fire suppression, and climate change (Madany and West 1983; Swetnam 1990; Touchan et al. 1995; Swetnam and Baisan 1996; Belsky and Blumenthal 1997; Gresswell 1999; Brown et al. 2004; McKenzie et al. 2004; Westerling et al. 2006).

Historically, wildfires were primarily cool-burning understory fires with return intervals of 3 to 7 years in ponderosa pine (*Pinus ponderosa*) (Swetnam and Dieterich 1985). Cooper (1960) concluded that prior to the 1950s, crown fires were extremely rare or nonexistent in the region. Since the mid-1980s, wildfire frequency in western forests was nearly four times the average of 1970 to 1986, and the total area burned was more than six and one half times the previous level (Westerling et al. 2006). The average length of fire season increased by 78 days when 1970 to 1986 is compared to 1987 to 2003, and the average time between discovery and control increased

from 7.5 days to 37.1 days for the same time frames (Westerling et al. 2006). McKenzie et al. (2004) suggested, based on models, that the length of the fire season will likely increase further and that fires in the western United States will be more frequent and more severe. In particular, they found that fire in New Mexico appears to be acutely sensitive to summer climate and temperature changes and may respond dramatically to climate warming. Changes in relative humidity, especially drying over the western United States, are also projected to increase the number of days of high fire danger (Brown et al. 2004). In 2003, over 200,000 acres burned in the Gila National Forest (in litt. 2004). Because Zuni bluehead sucker are found primarily in isolated, small streams, avoidance of ash flows is impossible, and opportunities for natural recolonization do not exist (Brown et al. 2001). Persistence of Zuni bluehead sucker in streams affected by fire and subsequent ash flows is problematic.

According to Merkel (1979), the lower Rio Nutria, Rio Pescado, and Zuni River drainages have been drastically altered by human activities. Many small impoundments, built primarily for watering livestock, partially prevent flows from reaching the mainstem rivers. Historical logging, road construction, and overgrazing by livestock destroyed much of the ground cover in the upper watershed. These practices caused serious erosion problems, increased stream flow fluctuation, and caused the accumulation of large quantities of sediment in the reservoirs (Merkel 1979). Reservoirs and diversion dams for irrigation not only have depleted stream flows but also inundated a number of stream reaches (Merkel 1979, Hanson 1982). The lower Rio Nutria and Rio Pescado drainages are dry much of the year except for those reaches that are fed by perennial springs (Merkel 1979).

The principal uses of surface and groundwater within the Zuni River watershed are human consumption, livestock, and irrigation. Diverting water for agricultural use is the primary purpose of at least five impoundments in the lower watershed, and several other reservoirs act as flood-control structures. Degradation of the upper watershed has led to increased sedimentation and many of the reservoirs are now only shallow, eutrophic ponds or wetlands with little or no storage capacity (NMDGF 2004). Sediment trapping by these impoundments has also changed the character of the streams by altering channel morphology and substrate composition. The lower Rio Nutria was once a perennial stream with generally wide meanders bordered by willow (*Salix* spp.) and cottonwood (*Populus* spp.). Now the channel is deeply incised and the substrate is predominantly silt or silt-sand within a broad-flat valley. Flow is intermittent between ephemeral pools and impoundments. Current habitat conditions are not favorable for Zuni bluehead sucker in much of the watershed downstream from the mouth of Rio Nutria Box. Upstream of the Canyon Box, permanent flow is associated with springs, and bedrock is the predominant substrate.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

The Zuni bluehead sucker is not a game fish and does not have recreational or commercial value. In addition, the Zuni bluehead sucker is listed as Endangered by the State of New Mexico (NMDGF 1999), and the State fishing regulations (NMDGF 1998) prohibit take of endangered species. The U.S. Fish and Wildlife Service (Service) has no information to indicate that collection for any purpose is a contributing factor to its imperiled status.

C. Disease or predation.

Nonnative predatory fishes (primarily green sunfish) have contributed to the displacement or elimination of the species from some of its historical range. Seventy-six species of nonnative fishes that compete with or prey upon native fishes have been introduced into New Mexico waters since about 1850 (Nico and Fuller 1999). Propst and Hobbes (1996) reported that several nonnative fish species had been established in the Zuni River drainage by the late 1970s. The fathead minnow and green sunfish were common in the Zuni River drainage at that time. In 2006, green sunfish dominated the catch in Agua Remora (Carman 2007), but since, dedicated eradication efforts have led to a significant decline in their numbers. The Zuni bluehead sucker occurs only in stream habitats that are comparatively free of nonnative fishes (Propst and Hobbes 1996; Carman 2009).

The virile crayfish was detected in the lower end of Rio Nutria in 2004. The virile crayfish is tolerant of a wide range of habitats and may be a threat to Zuni bluehead sucker through competition or predation. Crayfish have moved upstream approximately 0.062 mi (100 m) since first being detected in 2004 and co-occur with Zuni bluehead sucker in a small portion of occupied habitat (Carman 2009).

Black spot (diploptomiasis), a common fish parasite caused by a trematode, was found on many Zuni bluehead sucker in 2005 (Carman 2007). None was seen on the fish caught in 2006 or 2007, but it was seen on fish from Agua Remora and the Rio Nutria Box canyon in 2008 (Carman 2009). Although present, black spot is not considered a major threat at this time.

D. The inadequacy of existing regulatory mechanisms.

Existing regulatory mechanisms that could provide some protection for the Zuni bluehead sucker include: (1) New Mexico Wildlife Conservation Act; (2) Arizona Nongame and Endangered Species Program; (3) National Environmental Policy Act (NEPA); (4) National Forest Management Act; (5) Federal Endangered Species Act; and (6) Zuni Pueblo Law and Order Code. However, the regulatory mechanisms currently in place do not provide adequate protection for the Zuni bluehead sucker and its habitat.

State - The Zuni bluehead sucker is listed as endangered in New Mexico (NMDGF 1999). Under the New Mexico Wildlife Conservation Act of 1974, take of this species is prohibited, but the statute does not provide additional habitat protection or designation of critical habitat (NMDGF 1988; 1998). The Zuni bluehead sucker is listed as a Species of Special Concern by the State of Arizona (Arizona Game and Fish Department 1996), but this designation does not prohibit take. In 2007, the Arizona Game and Fish Department (AZGFD) identified the Zuni bluehead sucker as a state protected native fish and may not be possessed, but this lacks habitat protection (Kirk Young, AZGFD, pers. comm., 2010). Therefore, the effectiveness of the New Mexico and Arizona statutes to protect their listed species habitats has not been adequate to protect the Zuni bluehead sucker.

Federal - Agua Remora provides the only stream habitat (0.03 mi; 0.05 km) for the Zuni bluehead sucker on public land (Cibola National Forest). The Forest Service (1985) classifies

the Zuni bluehead sucker as sensitive in Arizona and New Mexico, which provides some limited protection. The National Forest Management Act requires the Forest Service to prepare management plans for each National Forest; a plan has been completed for the Cibola National Forest (U. S. Forest Service 1985). Forest plans must meet the requirements of the Natural Resources Multiple-Use Act to address such issues as recreation, range, timber, biological diversity, and economic and social factors in agency decision making. The 1985 Cibola National Forest Plan (Plan) includes a discussion for protection of the Zuni bluehead sucker. The Plan indicated that fencing would protect Zuni bluehead sucker riparian habitat, but improved range management was needed to restore the entire watershed. Specific projects that are proposed on land managed by the Forest Service must also be reviewed for NEPA compliance. This review analyzes the impact of the project on candidate species as well as listed species. Typically, efforts are made to minimize the impacts of a project on listed and candidate species. In addition, the Forest Service is currently working with the NMDGF to setup and maintain water monitoring wells in Zuni bluehead sucker habitat within the Rio Nutria watershed.

In 1980, the Service and NMDGF explored the possible listing of the Zuni bluehead sucker as an endangered species, but Federal listing did not occur (Service 1980a, 1980b; NMDGF 1980). This species was previously designated as a Category 2 candidate species in 1991 (Service 1991), a species for which we had data indicating that listing was possibly appropriate, but for which we lacked substantial data on biological vulnerability and threats to support a proposed rule. We discontinued designation of category 2 species in the February 28, 1996, Notice of Review (61 Federal Register (FR) 7956)). Candidate species under the new definition is a list of candidate species, for species that contain substantial information where listing is warranted but precluded by higher priority actions. Under this definition the Zuni bluehead sucker has been a candidate species since October 30, 2001 (66 FR 54808). The Endangered Species Act (Act) does not offer candidate species any direct protection; however, the Act may incidentally afford protection to a candidate if it coexists with species already listed as threatened or endangered. No other listed species are known to occur in the remaining Zuni bluehead sucker habitats.

Zuni Pueblo - The Zuni bluehead sucker, speckled dace, and grass carp (*Ctenopharyngodon idella*) are protected from fishing in Pueblo lakes (Zuni Pueblo Law and Order Code S7-5-3 paragraph. 36). In addition, stream fishing is prohibited on the Pueblo. These regulations protect the species from take by fishing but do not include regulations to protect Zuni bluehead sucker habitat.

E. Other natural or manmade factors affecting its continued existence.

Fish toxicants were used in at least two dozen treatments in the Nutria and Pescado Rivers between 1960 and 1975 to eradicate green sunfish and fathead minnows (Merkel 1979). Large numbers of suckers were killed during several of these treatments. One of these treatments killed substantial numbers of Zuni bluehead suckers in the upper Rio Nutria in 1967, and another killed suckers in Cebolla Creek in the Rio Pescado drainage in 1962 (Merkel 1979).

Endangered species and their habitats are sometimes targets for vandalism, especially in rural New Mexico where listed species are perceived as a threat to livelihoods and traditional ways of

life. Because the Zuni bluehead sucker is restricted to a few shallow pools during dry periods, it is vulnerable to poisoning or other forms of vandalism.

In 2006, beaver activity in Tampico Draw and Rio Nutria increased greatly, to the detriment of Zuni bluehead sucker habitat (Carman 2007). Suitable Zuni bluehead sucker habitat consists of flowing stream water, not standing pools. Beaver dams impound water and convert suitable habitat into unsuitable habitat. In addition, because water velocity in the ponds is negligible, suspended sediment falls to the bottom of the pool, covering the substrate. Zuni bluehead sucker scrape food from hard surfaces, and fine sediment deposition reduces the amount of food available.

The effect climate change may have on streams and forests of the Southwest is unpredictable. In consultation with leading scientists, the New Mexico Office of the State Engineer prepared a report for the Governor which made the following observations about the impact of climate change in New Mexico: 1) warming trends in the Southwest exceed global averages by about 50 percent; 2) models suggest that even moderate increases in precipitation would not offset the negative impacts to the water supply caused by increased temperature; 3) temperature increases in the southwest are predicted to continue to be greater than the global average; 4) there will be a delay in the arrival of snow, acceleration of spring snow melt, leading to a rapid and earlier seasonal runoff; and 5) the intensity, frequency, and duration of drought may increase (State of New Mexico 2006).

Consistent with the outlook presented for New Mexico, Hoerling (2007) predicts that relative to 1990-2005, simulations indicate a 25 percent decline in stream flow from 2006-2030 and a 45 percent decline during 2035-2060 in the Southwest. Seager et al. (2007) showed that there is a broad consensus among climate models that the Southwest will get drier in the 21st century and that the transition to a more arid climate is already under way. Only one of 19 models has a trend toward a wetter climate in the Southwest (Seager et al. 2007). Stewart et al. (2005) showed that timing of spring streamflow in the western United States during the last five decades has shifted so that the major peak now arrives 1 to 4 weeks earlier, resulting in less flow in the spring and summer. They concluded that almost everywhere in North America, a 10 to 50 percent decrease in spring-summer streamflow fractions will accentuate the seasonal summer dry period with important consequences for warm-season water supplies, ecosystems, and wildfire risks (Stewart et al. 2005). An increase in average mean air temperature of just over 1°C (2.5°F) in Arizona and New Mexico since 1976 has already been documented (Lenart 2007, p. 4). Udall (2007) found that multiple independent data sets confirm widespread warming in the west.

Streamflow is predicted to decrease in the Southwest even if precipitation were to increase moderately (Nash and Gleick 1993; State of New Mexico 2005; Hoerling 2007). Winter and spring warming causes an increased fraction of precipitation to fall as rain, resulting in a reduced snowpack, an earlier melt, and decreased summer runoff (Christensen et al. 2004; Stewart et al. 2005; Regonda et al. 2005). Earlier snowmelt and warmer air temperatures lead to a longer dry season, affecting streamflow. Warmer air temperatures lead to increased evaporation, increased evapotranspiration, and decreased soil moisture. These three factors lead to decreased streamflow. However, current models suggest a decrease in precipitation rather than an increase

(Seager et al. 2007; Kundzewicz et al. 2007), which would reduce flows even more than has been predicted.

The extended drought in the 2000s reduced the amount of flowing water in the creeks occupied by Zuni bluehead sucker. Inspection of the flow measured at the Rio Nutria U.S. Geological Survey (USGS) gage shows that the flow was less than 1 cubic foot per second (cfs) for the majority of the time since 2000, punctuated by a few large flows created by monsoonal rains (http://waterdata.usgs.gov/nm/nwis/uv/?site_no=09386900&PARAMeter_cd=00065,00060, accessed April 15, 2010). In July 2006, Zuni bluehead sucker were rescued from drying pools in Agua Remora (Carman 2008). From 1988 to 1998 there were 5 years in which flow exceeded 500 cfs, and in 2 of those years flow exceeded 1,000 cfs. Since 1999, there have not been any flows over 500 cfs. Flushing flows are needed to maintain habitat. Whether the decrease in peak flows are a reflection of climate change or a result of localized conditions is unknown. The basin forecast for 2010 is better than last year's 32 percent of average, with snowpack in the headwaters at 552 percent of average in the Zuni/Bluewater basin (<http://www.wcc.nrcs.usda.gov/cgibin/bor2.pl?state=nm&year=2010&month=4&format=text>, accessed April 15, 2010). Any event, either natural (drought) or human caused (e.g., groundwater pumping, climate change), that decreases the amount of water in streams occupied by Zuni bluehead sucker could have dire consequences on the remaining populations of this subspecies.

Note that the USGS gage is currently under water due to beaver pools and may not be a reliable source for flow information. Discussions have begun to identify if the gage should be removed and placed elsewhere free of flow obstruction, or if the beaver pool should be eliminated (http://nwis.waterdata.usgs.gov/nm/nwis/peak?site_no=09386900&agency_cd=USGS&format=html, accessed April 15, 2010).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Since the 1990s, NMDGF has been the lead agency for conservation of Zuni bluehead sucker, completing the state recovery plan in 2004 (Propst and Hobbes 1996; Carman 2004). Cooperators for the conservation effort are a private landowner, Zuni Pueblo, Forest Service, The Nature Conservancy (TNC), NMDGF, and the Service. NMDGF leads annual monitoring, coordinates habitat improvement projects with the landowners, and conducts research as necessary (genetic studies, captive rearing investigations).

In 2009, NMDGF and TNC purchased an additional mile of Rio Nutria upstream of TNC's Rio Nutria Preserve. This area of Rio Nutria held populations of Zuni bluehead sucker in the 1990s but recently appears to be seasonally dry. NMDGF is monitoring habitat conditions and assessing the possibility of restoration of suckers to this area. The entire Rio Nutria Preserve is held for the purpose of conservation and is not open to the public.

Zuni Pueblo has been removing beavers from occupied Zuni bluehead sucker habitat in the Rio Nutria Box Canyon since 2007 to encourage flow. Immediate results were not observed in 2007, but following flushing flows in 2008 and 2009, an improvement in the habitat (less silt) was

observed, most likely in response to beaver removal and a flushing flow (182 cfs) (Carman 2007-2009).

Nonnative green sunfish co-occur with Zuni bluehead sucker in Agua Remora and may be responsible for the lack of recruitment seen in this population from 2005 to 2008. In 2007 and 2008, NMDGF made specific efforts to remove green sunfish from Zuni bluehead sucker habitat. In 2007, a total of 81 green sunfish were removed; efforts in 2008 yielded only 2 green sunfish. In 2008, CPUE for green sunfish was the lowest recorded to date, and in 2009 no green sunfish were recovered (Carman 2009). Young Zuni bluehead sucker were found in the Agua Remora in 2009.

In 2008, NMDGF contracted with the University of New Mexico to investigate the conservation genetics of Zuni bluehead sucker populations in New Mexico. Results indicated that the two headwater spring populations are exhibiting signs of isolation and are very similar to each other. The population in the Rio Nutria exhibits the expected levels of diversity (Thomas and Wade 2009).

In 2007, NMDGF contracted the Albuquerque Biological Park (BioPark) to investigate holding and rearing of Zuni bluehead sucker. Approximately 80 Zuni bluehead sucker are being held at the BioPark in modified aquaria and specially designed mesocosms. Most of these fish were rescued from drying pools in July 2007 (Carman 2008), but many have died because of old age. Mortality has been quite low and has occurred primarily among the adult fish from Agua Remora. In May 2009, Zuni bluehead sucker originally taken from the headwater spring habitat spawned in the mesocosms and there are now approximately 40 young Zuni bluehead sucker in captivity.

SUMMARY OF THREATS

Zuni bluehead sucker range reduction and fragmentation has been caused by historical timber harvest, overgrazing by livestock, piscicide use, reservoir construction, irrigation withdrawals, and stocking of nonnative fish. These threats led to the direct killing of the fish where piscicides were used, degradation of habitat (primarily through increased sedimentation), and fragmentation of the habitat through reservoir construction. Ongoing threats include decreased, discontinuous surface water flow, habitat degradation from fine sediment deposition, subdivision development (through increased recreational use, increased threat of fire, increased probability of introduced species, and groundwater pumping), nonnative aquatic species, beavers, and climate change.

We find that the Zuni bluehead sucker is warranted for listing throughout all of its range; therefore, it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

LISTING PRIORITY:

THREAT

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent Non-imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3*
		Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent Non-imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
		Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: The range of Zuni bluehead sucker has been reduced by over 95 percent. The subspecies exists in about 3 mi (4.8 km) of headwater tributaries of the Rio Nutria, New Mexico, and a fraction of 27.5 mi (44 km) of potentially suitable habitat of Kinlichee Creek drainage, Arizona. There is limited connectivity among populations, and most are restricted to short (less than 0.6 mi (1 km)) reaches with permanent water (Propst 2001). There has been a significant decrease in the number of Zuni bluehead sucker since 1977. The subspecies no longer occurs in the Zuni River, Rio Pescado, or Dean Creek. We find that the magnitude of existing threats is high.

Imminence: Land management practices (especially road and residential development) continue to threaten the habitat of Zuni bluehead sucker. Subdivision development is expected to lead to increased use of the area by recreationists with potential impacts from fire, off highway vehicle use, introduction of nonnative species, and increased groundwater pumping in the subdivision. Dams and natural barriers block movement of fish and isolate the populations. Natural events, particularly drought or scouring floods after a fire, are significant threats. If the current drought worsens, extirpation of Zuni bluehead sucker in the wild could be imminent. Overall, we find that threats are ongoing and imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. Given the information we currently have on the status of the populations, we do not believe this subspecies should be emergency listed. One population is semiprotected because it occurs on land owned by TNC. There is a captive population being held at the BioPark. The effect of the drought and climate change on the populations is unknown.

DESCRIPTION OF MONITORING: As part of current efforts to recover the fish, NMDGF has been monitoring Zuni bluehead sucker annually since 2004 to assess the status of the species (NMDGF 2004; Carman 2007; 2008; 2009). This annual monitoring will aid tracking and assessment of the status of the Zuni bluehead sucker. However, lack of baseline data makes it difficult to put the current numbers and trends into a historical context.

Zuni Pueblo personnel conducted surveys of the Pueblo and other historical habitats in cooperation with the Service, Navajo Nation, and NMDGF in 2000, and the Pueblo was funded by the Service for surveys again in 2001 and 2004. East Clear Creek is the only historical Zuni bluehead sucker locality in New Mexico that was not resurveyed in 2000. Monitoring for the Arizona populations is not currently occurring due to the lack of funds, but the Navajo Nation is interested in conserving the Zuni bluehead sucker.

COORDINATION WITH STATES


Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: New Mexico, Arizona

Indicate which State(s) did not provide any information or comments: None

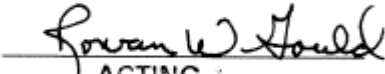
LITERATURE CITED

Literature cited will be provided on request.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  May 21, 2010

Acting Regional Director, Fish and Wildlife Service Date

Concur:  Date: October 22, 2010

ACTING :
Director, Fish and Wildlife Service

Do not concur: _____
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review: April 2010
Conducted by: Melissa Mata